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NATIONAL DAM SAFETY PROGRAM. KATY ALLEN LAKE DAM (MO 20207), OS--ETC(U)
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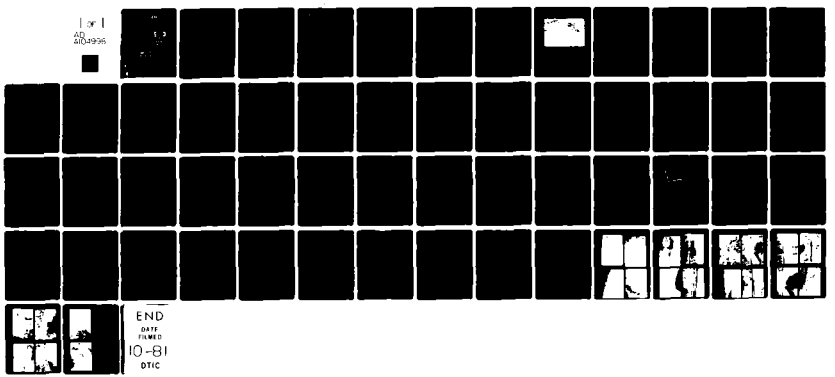

LEVEL II

1

OSAGE-GASCONADE BASIN

KATY ALLEN LAKE DAM
VERNON COUNTY, MISSOURI
MO 20207

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
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St. Louis District

PREPARED BY: U.S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

SEPTEMBER, 1979

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20. ABSTRACT *(Continue on reverse side if necessary and identify by block number)* This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.	

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Katy Allen Dam Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Katy Allen Dam:

It was prepared under the National Program of Inspection of Non-Federal Dams.

This dam has been classified as unsafe, non-emergency by the St. Louis District as a result of the application of the following criteria:

1) Spillway will not pass 50 percent of the Probable Maximum Flood.
2) Overtopping could result in dam failure.
3) Dam failure significantly increases the hazard to loss of life downstream.

SUBMITTED BY: SIGNED
Chief, Engineering Division

19 SEP 1979
Date

APPROVED BY: SIGNED
Colonel, CE, District Engineer

19 SEP 1979
Date

KATY ALLEN DAM

VERNON COUNTY, MISSOURI

MISSOURI INVENTORY NO. 20207

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Prepared by

Anderson Engineering, Inc. Springfield, Missouri
Hanson Engineers, Inc., Springfield, Illinois

Under Direction of

St. Louis District, Corps of Engineers

For

Governor of Missouri

August, 1979

PHASE I REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Katy Allen Dam
State Located:	Missouri
County Located:	Vernon County
Stream:	Willow Branch
Date of Inspection:	21 June 1979

Katy Allen Dam was inspected by an interdisciplinary team of engineers from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and visual inspection, in order to determine if the dam poses hazards to human life or property.

The guidelines used in the assessment were furnished by the Department of the Army, Office of the Chief of Engineers, and they have been developed with the help of several Federal and State agencies, professional engineering organizations, and private engineers. Based on these guidelines, the St. Louis District, Corps of Engineers has determined that this dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur if the dam fails. The estimated damage zone extends approximately 3 miles downstream of the dam. Located within this zone are 15 dwellings.

The dam is in the small size classification, since it is equal to or greater than 25 ft. high but less than 40 ft. high and the maximum storage capacity is greater than 50 acre-ft. but less than 1000 acre-ft.

Our inspection and evaluation indicates that the combined spillways do not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. The combined spillways will pass 41 percent of the Probable Maximum Flood without overtopping. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The guidelines require that a dam of small size with a high downstream hazard potential pass 50

to 100 percent of the PMF. Considering the small volume of water impounded and the height of the dam, 50 percent of the PMF has been determined to be the appropriate spillway design flood. The 100-year frequency flood will not overtop the dam. The 100-year flood is one that has a 1 percent chance of being exceeded in any given year.

The embankment appeared to be generally in fairly good condition. Deficiencies visually observed by the inspection team were: (1) Erosion of upstream face; (2) Heavy brush and trees up to 2 feet in diameter on both faces of the dam; (3) Concrete spillway section below crests of both spillways are broken and undermined; (4) Seepage at downstream toe and on flood plain covering center one-third of dam; and (5) two foot diameter tree in approach channel of south spillway and considerable plant growth in the approach to the north spillway.

Another deficiency was the lack of seepage and stability analysis records.

It is recommended that the owners take the necessary action in the near future to correct the deficiencies reported herein. A detailed discussion of these deficiencies is included in the following report.

John M. Healy, P.E.
Hanson Engineers, Inc.

Gene Wertepny, P.E.
Hanson Engineers, Inc.

Steven L. Brady, P.E.
Anderson Engineering, Inc.

John Renner, EIT
Anderson Engineering, Inc.

Tom Beckley, P.E.
Anderson Engineering, Inc.

AERIAL VIEW OF LAKE AND DAM

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

KATY ALLEN DAM ID No. 20207

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APPENDICES

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL:

A. Authority:

The National Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of safety inspection of dams throughout the United States. Pursuant to the above, the St. Louis District, Corps of Engineers, District Engineer directed that a safety inspection be made of Katy Allen Dam in Vernon County, Missouri.

B. Purpose of Inspection:

The purpose of the inspection was to make an assessment of the general condition of the dam with respect to safety, based upon available data and a visual inspection in order to determine if the dam poses hazards to human life or property.

C. Evaluation Criteria:

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief Engineers, "Recommended Guidelines for Safety Inspection of Dams, Appendix D." These guidelines were developed with the help of several federal agencies and many state agencies, professional engineering organizations, and private engineers.

1.2 DESCRIPTION OF PROJECT:

A. Description of Dam and Appurtenances:

Katy Allen Dam is an earth fill structure approximately 25 ft. high and 550 ft. long at the crest. The appurtenant works consist of two overflow spillways. The spillway at the north end of the embankment consists of 60 foot long concrete control section with a 22 foot long concrete control section as the spillway at the south end of the embankment. Sheet 3 of Appendix A shows a plan profile and typical section of the embankment.

B. Location:

The dam is located in the central part of Vernon

County, Missouri on Willow Branch. The dam and lake are within the Nevada, Missouri 7.5 minute quadrangle sheet (Section 3, T35N, R31W - latitude 37° 50.4'; longitude 94° 20.2'). Sheet 2 of Appendix A shows the general vicinity.

C. Size Classification:

With an embankment height of 25 ft. and a maximum storage capacity of approximately 113 acre-ft., the dam is in the small size category.

D. Hazard Classification:

The St. Louis District, Corps of Engineers has classified this dam as a high hazard dam. The estimated damage zone extends approximately 3 miles downstream of the dam. Located within this zone are 15 dwellings.

E. Ownership:

The dam is owned by Vernon County, Missouri. The owner's address is: Vernon County Court, Nevada, Missouri 64772.

F. Purpose of the Dam:

The dam was constructed primarily for recreational purposes.

G. Design and Construction History:

No design information or plans are available. The dam was built by the M-K-T Railroad and completed in 1910. The dam was later deeded to Vernon County by the Railroad. To our knowledge no modifications have been made except that some additional concrete appears to have been added to both spillways.

H. Normal Operative Procedures:

All flows are passed by two concrete spillways located at each end of the embankment. A local resident indicated that the highest water over the spillway was 6 to 8 inches in the last 8 years.

1.3 PERTINENT DATA:

Pertinent data about the dam, appurtenant works, and

reservoir are presented in the following paragraphs. Sheet 3 of Appendix A presents a plan, profile and typical section of the embankment.

A. Drainage Area:

The drainage area for this dam, as obtained from the U.S.G.S. quad sheet, is approximately 625 acres.

B. Discharge at Dam Site:

(1) All discharge at the dam site is through uncontrolled spillways.

(2) Estimated Total Spillway Capacity at Maximum Pool (Top of Dam - El. 848.7 ft. MSL): 2635 cfs

(3) Estimated Capacity of Primary Spillway (South): 975 cfs

(4) Estimated Experienced Maximum Flood at Dam Site: 400 cfs (At high water mark, 845.8 ft. MSL)

(5) Diversion Tunnel Low Pool Outlet at Pool Elevation: Not Applicable

(6) Diversion Tunnel Outlet at Pool Elevation: Not Applicable

(7) Gated Spillway Capacity at Pool Elevation: Not Applicable

(8) Gated Spillway Capacity at Maximum Pool Elevation: Not Applicable

C. Elevations:

(1) Top of Dam: 848.7 ft. MSL (Low Point); 849.3 ft. MSL (High Point)

(2) Principal Spillway Crest (South): 844.6 ft. MSL

(3) Emergency Spillway Crest (North): 845.1 ft. MSL

(4) Principal Outlet Pipe Invert: Not Applicable

(5) Streambed at Centerline of Dam: 824.4 ft. MSL

(6) Pool on Date of Inspection: 844.4 ft. MSL

(7) Maximum Tailwater: Unknown

(8) Upstream Portal Invert Diversion Tunnel: Not Applicable

(9) Downstream Portal Invert Diversion Tunnel: Not Applicable

D. Reservoir Lengths:

(1) At Top of Dam: 2600 Feet

(2) At Principal Spillway Crest: 1600 Feet

(3) At Emergency Spillway Crest: 1600 Feet

E. Storage Capacities:

(1) At Principal Spillway Crest: 60 Acre-Feet

(2) At Top of Dam: 113 Acre-Feet

(3) At Emergency Spillway Crest: 72 Acre-Feet

F. Reservoir Surface Areas:

(1) At Principal Spillway Crest: 12 Acres

(2) At Top of Dam: 14 Acres

(3) At Emergency Spillway Crest: 12+ Acres

G. Dam:

(1) Type: Earth Fill

(2) Length at Crest: 550 Feet

(3) Height: 25 Feet

(4) Top Width: 5 Feet

(5) Side Slopes: Upstream 1.7H:1.0V; Downstream 1.9H:1.0V

(6) Zoning: Apparently homogeneous

(7) Impervious Core: Unknown

(8) Cutoff: Unknown

(9) Grout Curtain: Unknown

H. Diversion and Regulating Tunnel:

(1) Type: None

(2) Length: Not Applicable

(3) Closure: Not Applicable

(4) Access: Not Applicable

(5) Regulating Facilities: Not Applicable

I. Spillway:

I.1 Principal Spillway:

(1) Location: South Abutment

(2) Type: Shelved into natural sandstone bedrock with concrete control section.

I.2 Emergency Spillway:

(1) Location: North Abutment

(2) Type: Shelved into natural sandstone with concrete control section.

J. Regulating Outlets:

There are no regulating outlets or permanent draindown facilities for this dam.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN:

No engineering data exists for this dam. No construction inspection records or documented maintenance and operation data exist to our knowledge.

A. Surveys:

No detailed surveys have been made of the dam to our knowledge. The north end of the north concrete spillway control section was used as datum for our field survey. This was then tied to a road intersection centerline 1000 feet north of the dam. This intersection MSL elevation of 861 was used in this report.

B. Geology and Subsurface Materials:

The site is located in the Western Plains geologic region of Missouri. The Western Plains region is characterized topographically by being level to gently undulating with wide imperceptibly rising floodplains. The sedimentary rock layers exposed in the Ozarks region dip downward away from the Ozarks region and the higher and younger sedimentary deposits become the surface ledges in southwest Missouri. Generally the soils in the Western Plains region are residual from limestone, shale and sandstone with some loess cover in some areas. Pennsylvanian sandstone and shale above the Mississippian formations formed the parent material for the soils found in the area of the Katy Allen Dam.

Soils in the area of the dam appear to be primarily fine sandy, silty clays with some sandstone fragments. The soils are of the Parsons - Dennis - Bates soil association. The loessial thickness map (Sheet 2 of Appendix B) indicates that some areas of this region may have between 2.5 and 5.0 feet of loess cover.

The "Geologic Map of Missouri" indicates that the nearest known fault runs in a northwest-southeasterly direction approximately 10 miles southwest of the dam site. The Missouri Geological Survey has indicated that the faults in this area are generally considered to be inactive and have been for several hundred million years. The publication "Caves of Missouri" indicates there are no known caves in Vernon County.

C. Foundation and Embankment Design:

No design computations are available. We were unable to determine the source of the material for the embankment. Our site inspection indicates that these materials are primarily residual sandy, silty clays. No internal drainage features are known to exist nor did these appear to be any particular zoning of the embankment. No construction inspection records are available.

D. Hydrology and Hydraulics:

No hydrologic or hydraulic design data were obtained. Our analyses of the PMF are presented in Appendix C. These analyses were based on our field survey and observations, and estimates of areas and volumes from the U.S.G.S. quad sheet. It was concluded that the structure will pass 41 percent of the Probable Maximum Flood without overtopping. The 100-year frequency flood will not overtop the dam.

E. Structure:

The only appurtenant structures associated with this dam are the two concrete spillways. The control sections are in fair condition. The concrete below the crest is broken and the north spillway is apparently undermined as water was running under the concrete.

2.2 CONSTRUCTION:

No construction inspection data have been obtained.

2.3 OPERATION AND MAINTENANCE:

There are no operating records to our knowledge. The amount of trees and brush on the dam indicates the dam is not maintained on any regular basis.

2.4 EVALUATION:

A. Availability:

No engineering data, seepage or stability analysis, or construction test data were available.

B. Adequacy:

The engineering data available were inadequate to make

a detailed assessment of the design, construction, and operation. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency. These seepage and stability analyses should be performed for appropriate loading conditions (including earthquake loads) and made a matter of record.

C. Validity:

To our knowledge, no valid engineering data on the design or construction of the embankment are available.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS:

A. General:

The field inspection was made on 21 June 1979. The inspection team consisted of personnel from Anderson Engineering, Inc. of Springfield, Missouri and Hanson Engineers, Inc. of Springfield, Illinois. The team members were:

John M. Healy-Hanson Engineers, Inc.(Geotechnical Engineer)
Gene Wertepny - Hanson Engineers, Inc.(Hydraulics Engineer)
Steven L. Brady - Anderson Engineering, Inc. (Civil Engineer)
Tom Beckley - Anderson Engineering, Inc. (Civil Engineer)
John Renner - Anderson Engineering, Inc. (Civil Engineer)

B. Dam:

The embankment appears to have been built in a fairly straight line. The crest of the dam fluctuates somewhat with variations up to a foot in height. The dam is covered on both faces with brush and trees. Some of the trees are up to 2 foot in diameter. This made it very difficult to closely examine the embankment.

No surface cracks or unusual movement was noted. The front face of the dam has had considerable erosion probably due to wave action. No riprap was noted. No sloughing was noted. Shallow auger probes into the embankment indicated the embankment surface to consist of brown to light reddish brown sandy, silty clay. No animal burrows were noted, although some could exist and not be seen because of the heavy brush and tree growth.

Seepage was noted on lower part of the downstream face in the middle third of the embankment and in the flood plain immediately beyond the toe of the dam. Considerable reed growth was noted in this area. Water was observed in several areas however no movement of the water or transportation of soil was noted. One area of seepage had iron oxide staining.

No instrumentation (monuments, piezometers, etc.) was observed.

C. Appurtenant Structure:

C.1 Primary Spillway:

The approach to the south spillway has a 2 foot diameter tree in the middle of the channel. Concrete control wall appears in fairly good shape. The section should be checked for possible undermining. Concrete channel below crest is badly weathered, broken and apparently undermined. The spillway below the concrete section is well away from the dam and the base has eroded down to sandstone bedrock.

C.2 Emergency Spillway:

The approach to the north spillway is open except for considerable plant growth in the water. The concrete control section is undermined but appears to be stable at this time. The control section should be inspected to determine the extent of the undermining. The concrete spillway section is badly broken and water flows under the slab. The spillway below the concrete section is well away from the embankment and the base has eroded down to sandstone bedrock.

D. Reservoir:

The slopes adjacent to the lake are flat and no sloughing or serious erosion was noted. The watershed is primarily crop land. The lake has apparently silted in considerably. The lake does not appear to be in good condition as it contains considerable plant growth and algae.

E. Downstream Channel:

The outlet channels are brush and tree lined. The channels converge and pass through a box culvert under a road approximately 400 feet below the dam.

3.2 EVALUATION:

Trees and brush on the dam should be cleared and the dam cleared in the future on an annual basis. Trees and plants in the approach channels of the two spillways should be removed. The erosion damage on the upstream face should be repaired and maintained. The seepage areas noted on the downstream face and on the flood plain should be investigated by an engineer experienced in the design and construction of dams.

The two concrete spillways should be examined by an engineer to determine the extent of undermining and the condition of the concrete. Both spillways may need to be rebuilt.

Photographs of the dam, appurtenant structures, and the reservoir are presented in Appendix D.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES:

There are no controlled outlet works for this dam. The two spillways are uncontrolled, so that the pool is normally controlled by rainfall, runoff and evaporation.

4.2 MAINTENANCE OF DAM:

The dam apparently has not been maintained on any regular basis.

4.3 MAINTENANCE OF OPERATING FACILITIES:

There are no operating facilities for this dam.

4.4 DESCRIPTION OF ANY WARNING SYSTEM IN EFFECT:

The inspection team is unaware of any existing warning system for this dam.

4.5 *EVALUATION:*

Trees and brush should be cut annually. Erosional areas should be maintained. The dam should be periodically inspected to detect possible seepage under or through the embankment.

SECTION 5 - HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES:

A. & B. Design and Experience Data:

The hydraulic and hydrologic analyses were based on: (1) a field check of spillway dimensions and embankment elevations; and (2) an estimate of the pool and drainage areas from the U.S.G.S. quad sheet. No previous hydraulic or hydrologic studies were obtained. Our hydrologic and hydraulic analyses using U.S. Army Corps of Engineers guidelines appear in Appendix C.

C. Visual Observations:

Several trees existed in the approach to the south spillway. The two spillways are in need of repair as both are apparently undermined. The channels below the spillways have eroded down to sandstone bedrock. There was considerable plant growth in the approach channel into the north spillway. Both spillway channels are well away from the embankment, and spillway releases would not be expected to endanger the dam.

D. Overtopping Potential:

Based on the hydrologic and hydraulic analysis presented in Appendix C, the spillways will pass 41 percent of the Probable Maximum Flood. The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The recommended guidelines from the Department of the Army, Office of the Chief Engineers, require that this structure (small size with high downstream potential pass 50 percent to 100 percent of the PMF, without overtopping. Considering the small volume of water impounded, and the height of the dam, 50 percent of the PMF has been determined to be the appropriate spillway design flood. The structure will pass a 100-year frequency flood without overtopping.

The routing of 50 percent of the PMF through the spillways and dam indicate that the dam will be overtopped by 0.3 ft. at elevation 849.0 ft., MSL. The duration of the overtopping will be 0.58 hours and the maximum outflow will be 3372 cfs. The maximum discharge capacity of the spillways

is 2635 cfs. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY:

A. Visual Observations:

Visual observations which could adversely affect the structural stability of this dam are discussed in Sections 3.1B and 3.2.

B. Design and Construction Data:

No design and construction data for the foundation and embankment were available. Seepage and stability analyses comparable to the requirements of the guidelines were not available, which constitutes a deficiency which should be rectified.

C. Operating Records:

No operating records have been obtained.

D. Post-Construction Changes:

The inspection team is not aware of any post-construction changes to the dam although it did appear that some concrete had been added over the years to each spillway control section.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in stability analyses for this dam.

SECTION 7 - ASSESSMENT/REMEDIAL MEASURES

7.1 DAM ASSESSMENT:

This Phase I inspection and evaluation should not be considered as being comprehensive since the scope of work contracted for is far less detailed than would be required for an in-depth evaluation of dams. Latent deficiencies, which might be detected by a totally comprehensive investigation, could exist.

A. Safety:

The embankment is generally in fairly good condition. Several items were noted during the visual inspection which should be corrected or controlled. These items are: (1) heavy brush and tree growth on the dam; (2) erosion on the front face of the dam; (3) seepage areas along the downsteam face and at the toe; (4) undermining of concrete control sections of spillways; (5) broken and weathered concrete in in spillway outlet channel; (6) tree and plant growth in the approaches to the spillways; and (7) lack of erosion protection on south side of the south outlet channel next to the road. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considerered a deficiency.

The dam will be overtopped by flows in excess of 41 percent of the Probable Maximum Flood. Overtopping of an earthen embankment could cause serious erosion and could possibly lead to failure of the structure.

B. Adequacy of Information:

The conclusions in this report were based on review of the information listed in Section 2.1, the performance history as related by others, and visual observation of external conditions. The inspection team considers that these data are sufficient to support the conclusions herein. Seepage and stability analyses comparable to the "Recommended Guidelines for Safety Inspection of Dams" were not available, which is considered a deficiency.

C. Urgency:

The remedial measures recommended in paragraph 7.2

should be accomplished in the near future. If the deficiencies listed in paragraph A are not corrected, and if good maintenance is not provided, the embankment condition will continue to deteriorate and possibly could become serious in the future. Priority should be given to repairing and increasing the size of the spillways.

D. Necessity for Phase II:

Based on the result of the Phase I inspection, no Phase II inspection is recommended.

E. Seismic Stability:

The structure is located in seismic zone 1. An earthquake of this magnitude would not generally be expected to cause severe structural damage to a well constructed earth dam of this size. However, it is recommended that the prescribed seismic loading for this zone be applied in any stability analyses performed for this dam.

7.2 REMEDIAL MEASURES:

The following remedial measures and maintenance procedures are recommended. All remedial measures should be performed under the guidance of a professional engineer experienced in the design and construction of dams.

(1) Spillway size and/or height of dam should be increased to pass 50 percent of the PMF. In either case, the spillways should be protected to prevent erosion.

(2) Seepage and stability analyses comparable to the requirements of the recommended guidelines should be performed by an engineer experienced in the construction of dams.

(3) Brush and tree growth should be removed from the dam. This should be done under the guidance of a professional engineer experienced in the design and construction of dams. Indiscriminate clearing methods could jeopardize the safety of the dam.

(4) Erosion areas on the upstream face should be corrected and maintained. This could possibly require the installation of riprap.

(5) The seepage areas along the downstream face at the

downstream toe should be evaluated by an engineer experienced in the design of dams.

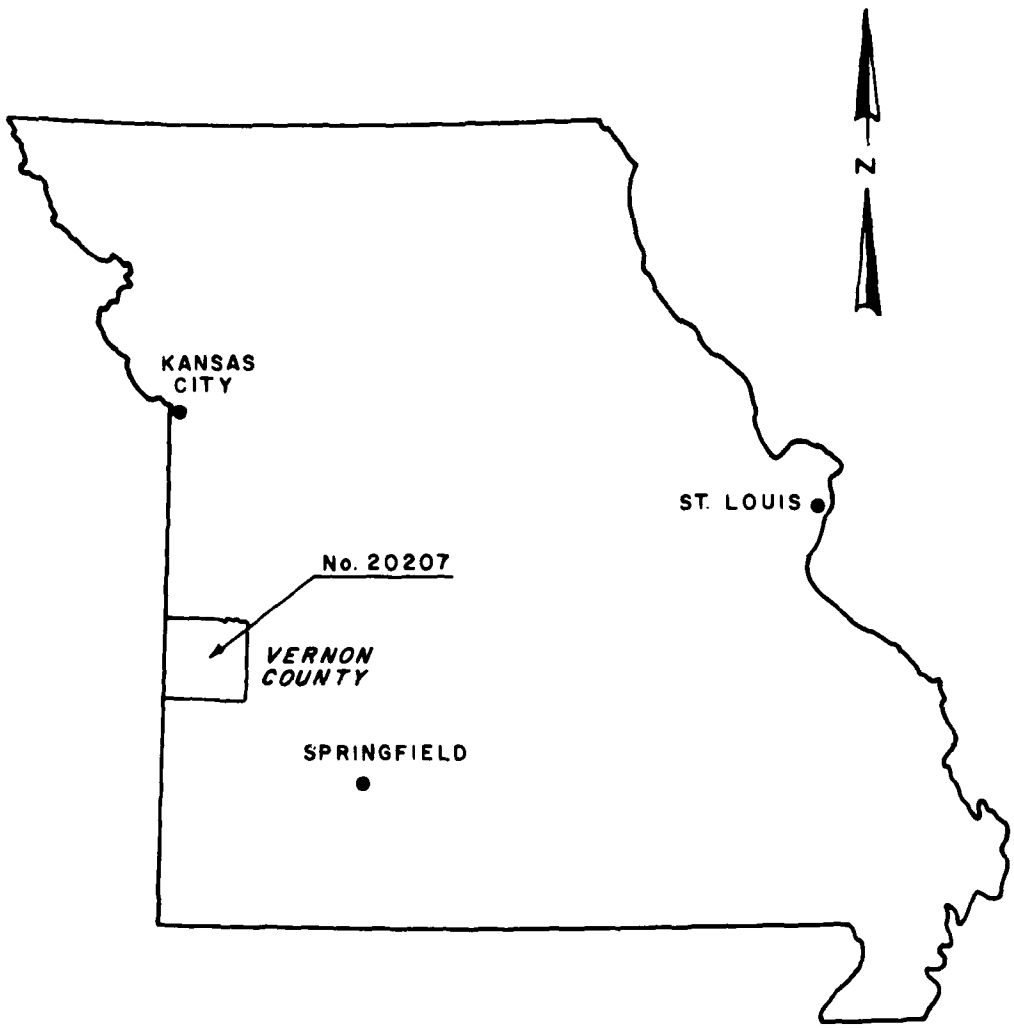
(6) The concrete control sections and concrete spillway outlets should be inspected by a professional engineer to determine extent of undermining and if necessary rehabilitation of these structures.

(7) The large tree in the approach to the south spillway and the plants in the approach to the north spillway should be removed.

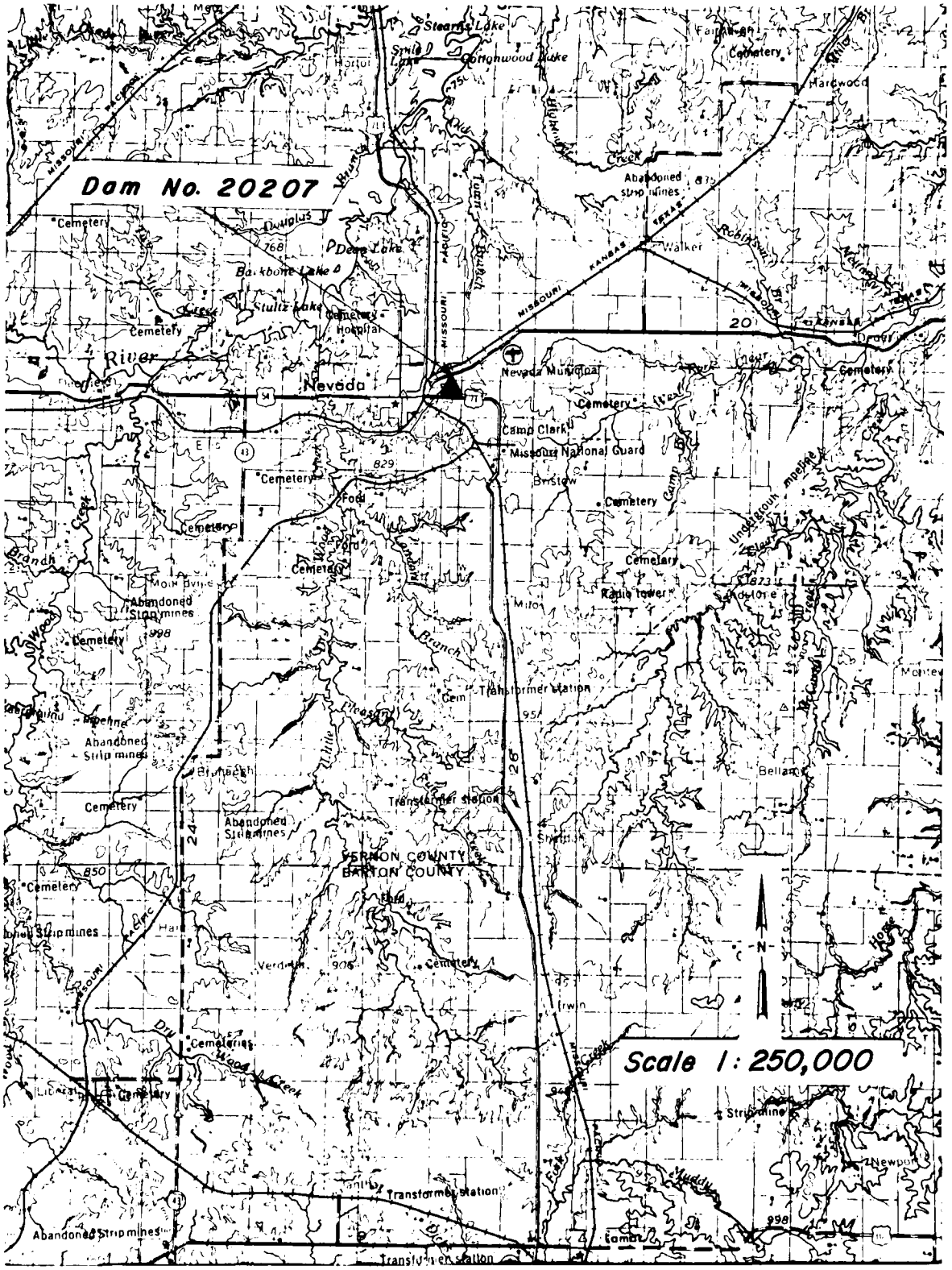
(8) Erosion protection should be provided on the south bank of the south spillway where the channel is eroding into the adjacent roadbed.

(9) A detailed inspection of the dam should be made periodically by an engineer experience in the design and construction of dams.

APPENDIX A

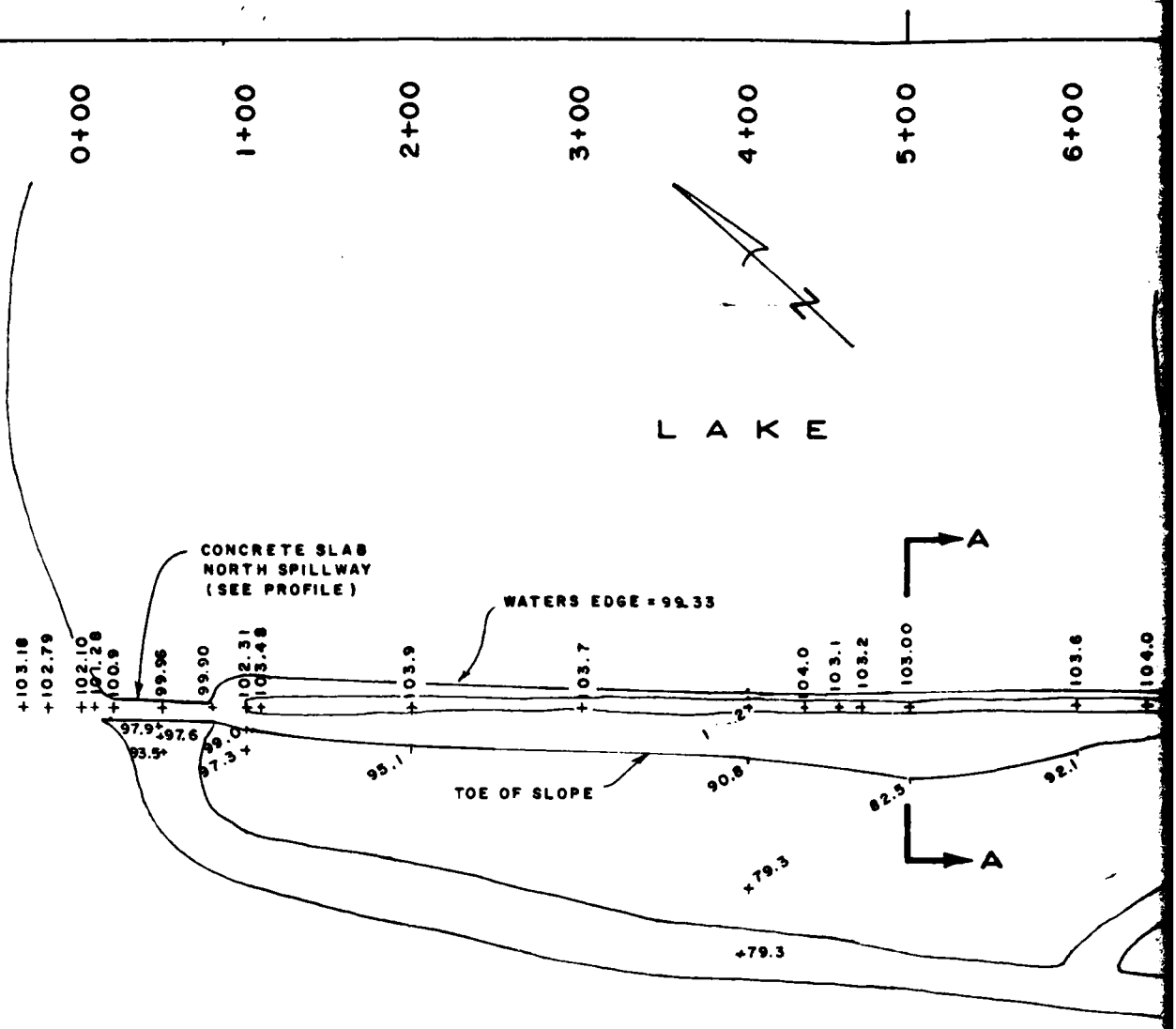


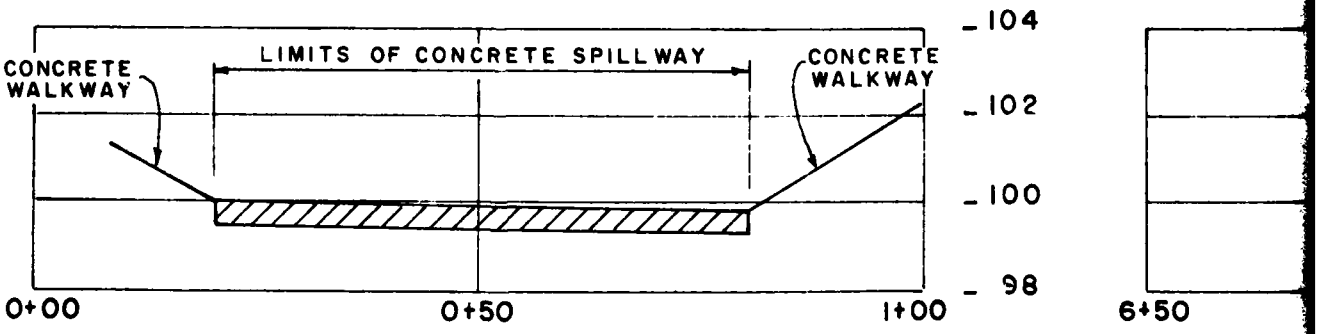
LOCATION MAP



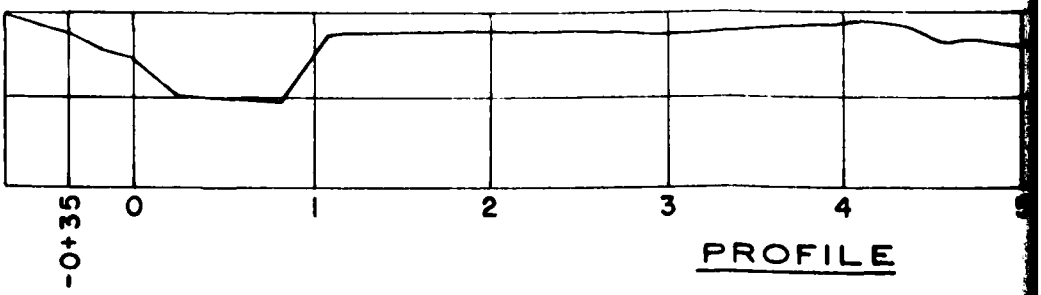
SITE VICINITY MAP

Sheet 2 Appendix A

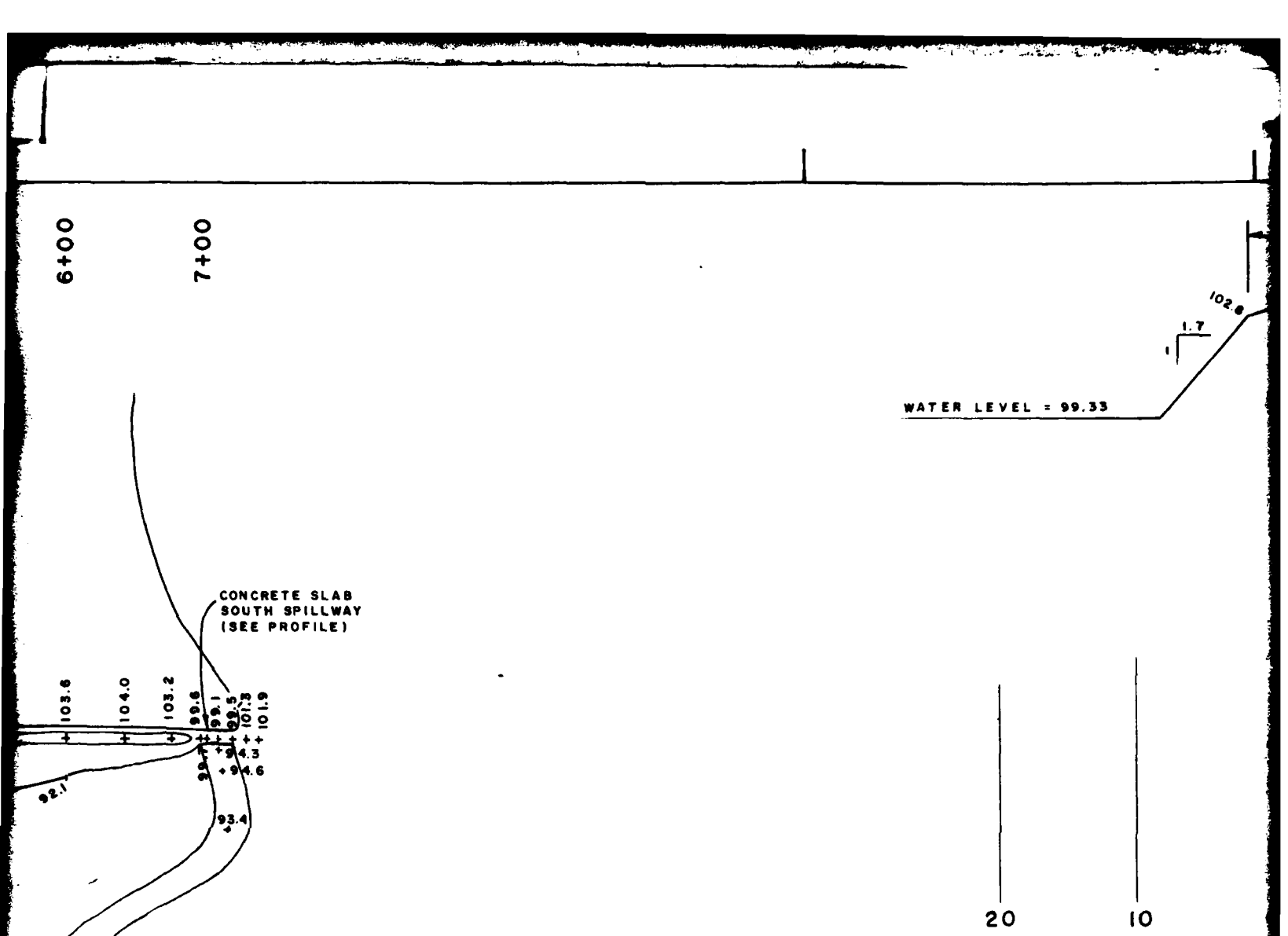




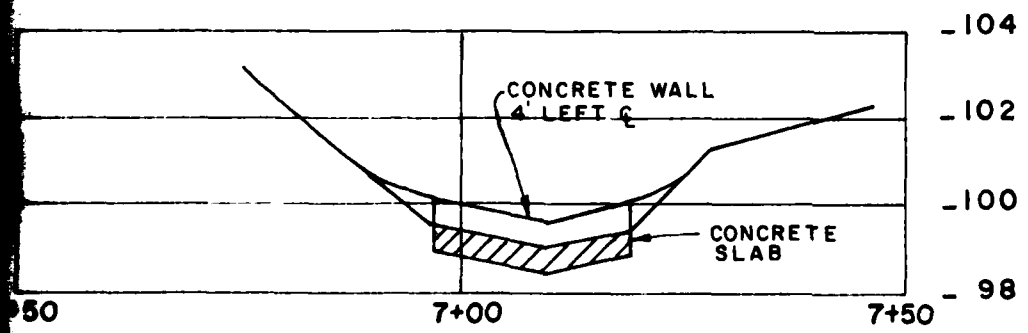
NORTH SPILLWAY PROFILE



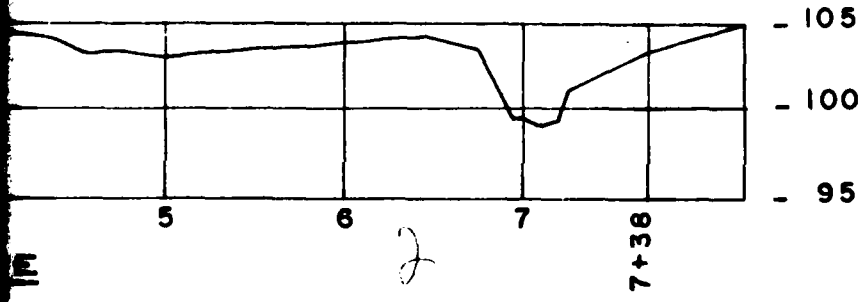
PROFILE

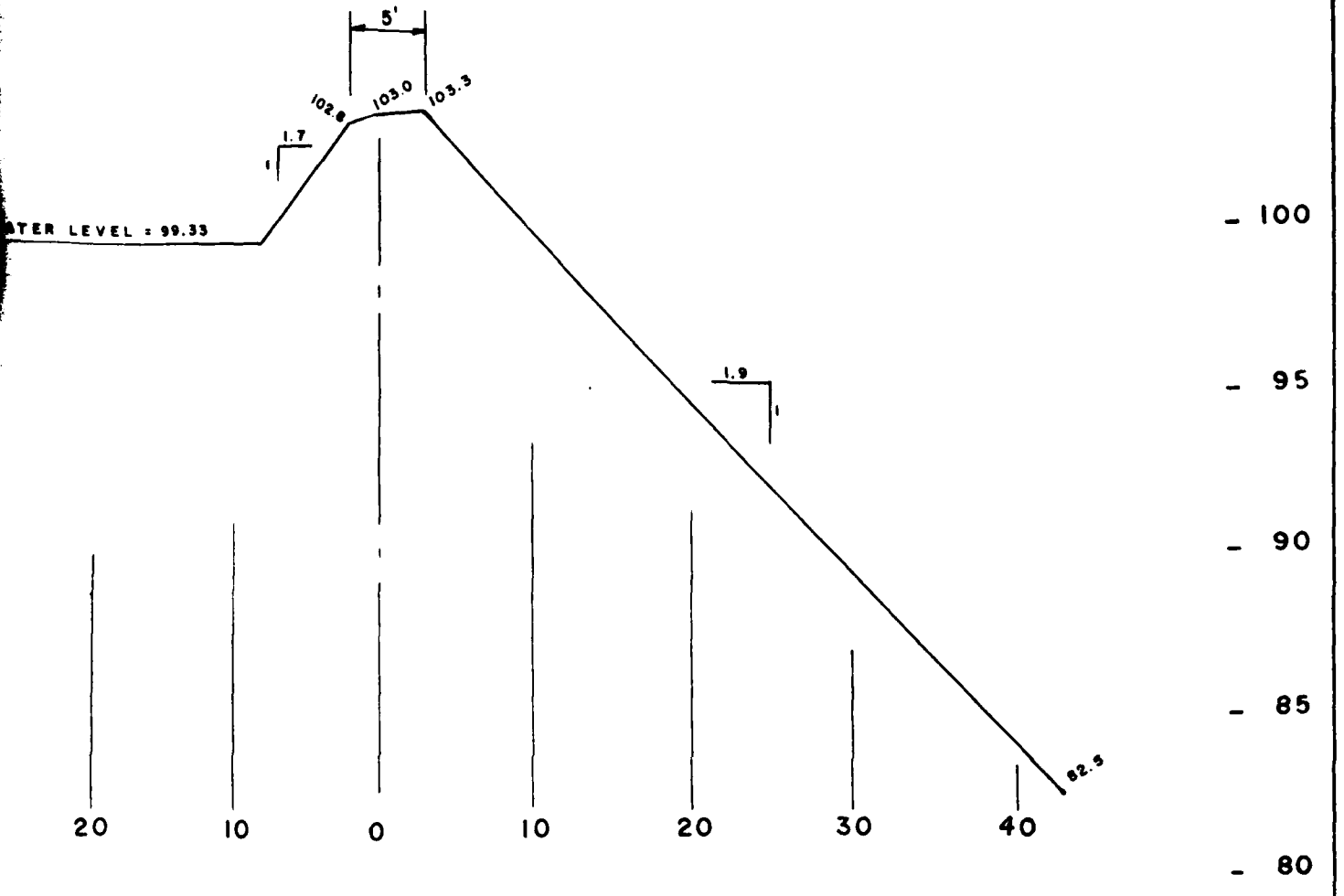


SECTION



SOUTH SPILLWAY PROFILE





SECTION A-A STA 5+00

ELEVATION EQUATION:
FIELD B.M. ELEV. = 100.00 =
USGS ELEV. = 845.11

Sheet 3 of Appendix A

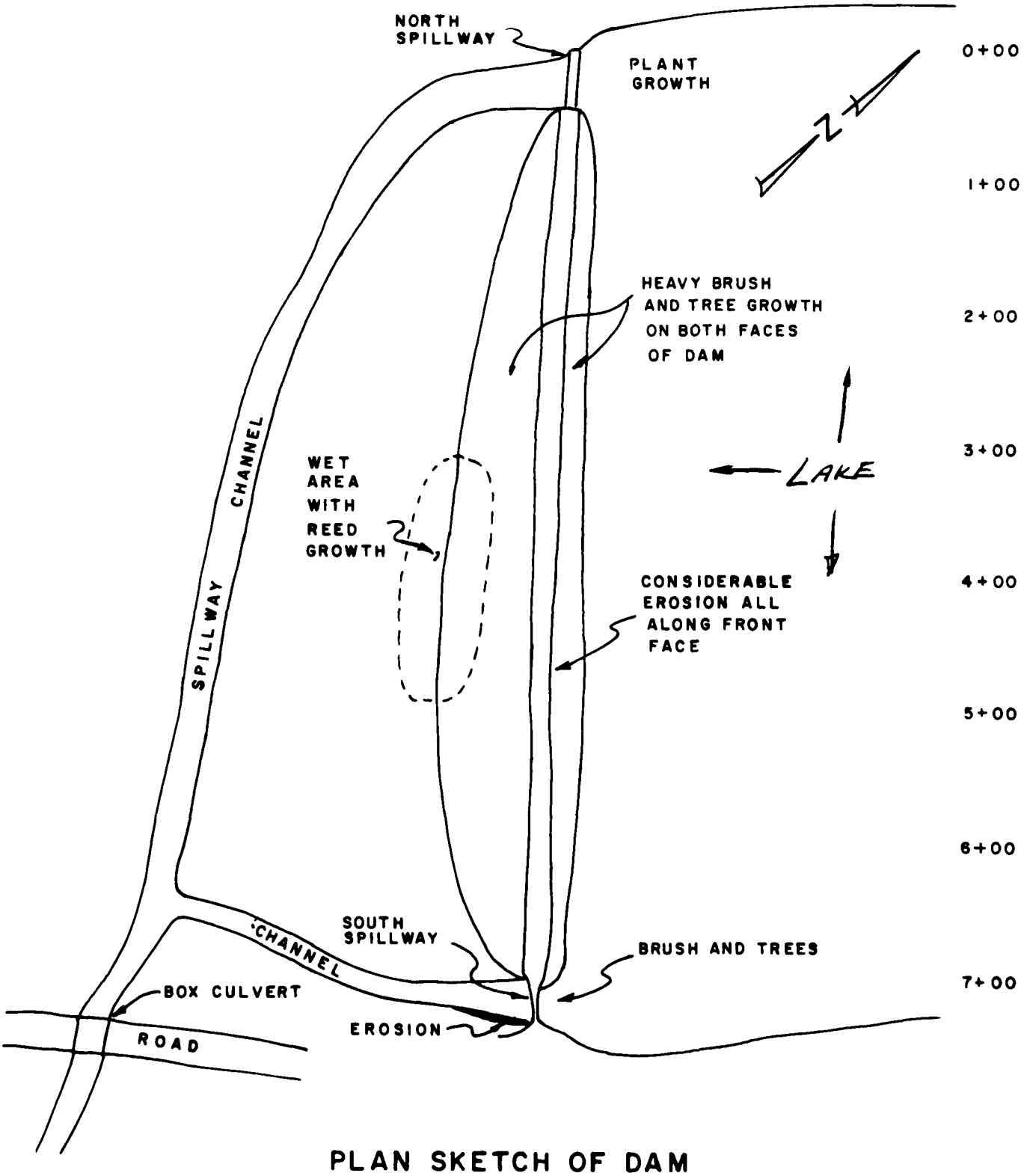
ANDERSON ENGINEERING, INC.
730 NORTH BENTON AVENUE
SPRINGFIELD, MISSOURI 65802

KATY ALLEN DAM

MO. No. 20207

PLAN & PROFILE

VERNON COUNTY, MO.

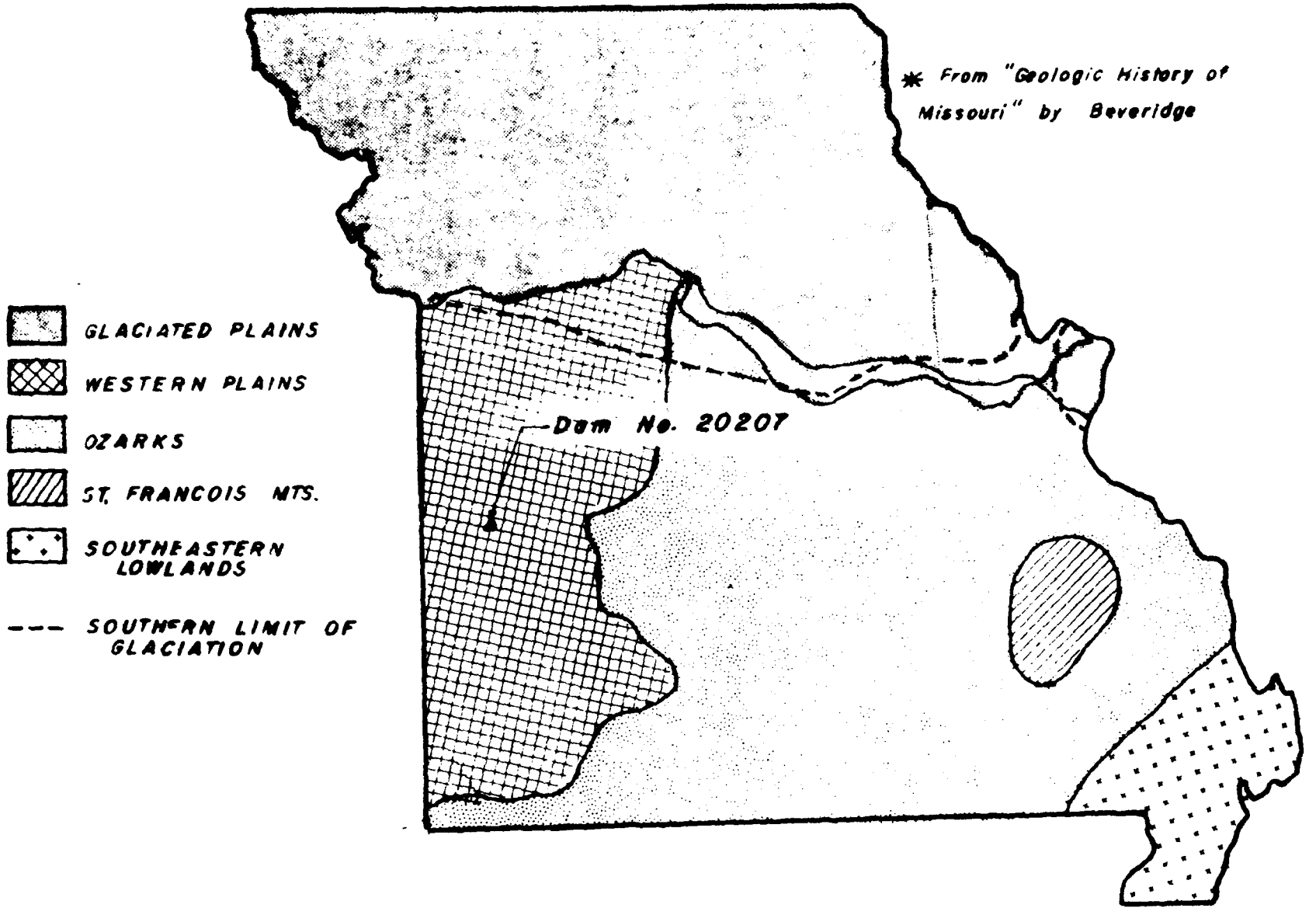


PLAN SKETCH OF DAM

MO. 20207

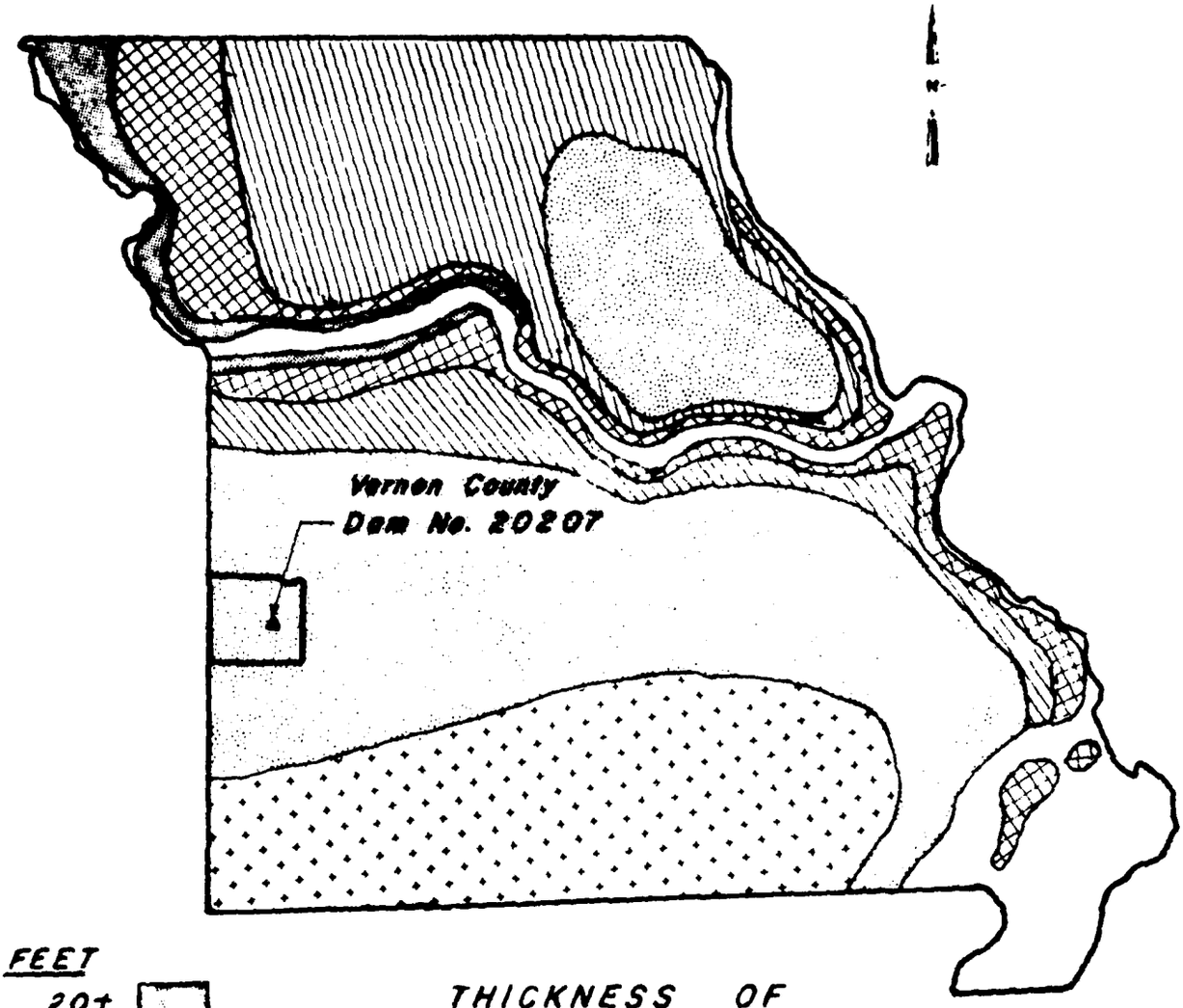
APPENDIX B

MAJOR GEOLOGIC REGIONS OF MISSOURI



SHEET 1 OF APPENDIX B

* From "Soils of Missouri"



FEET

20+

10-20

5-10

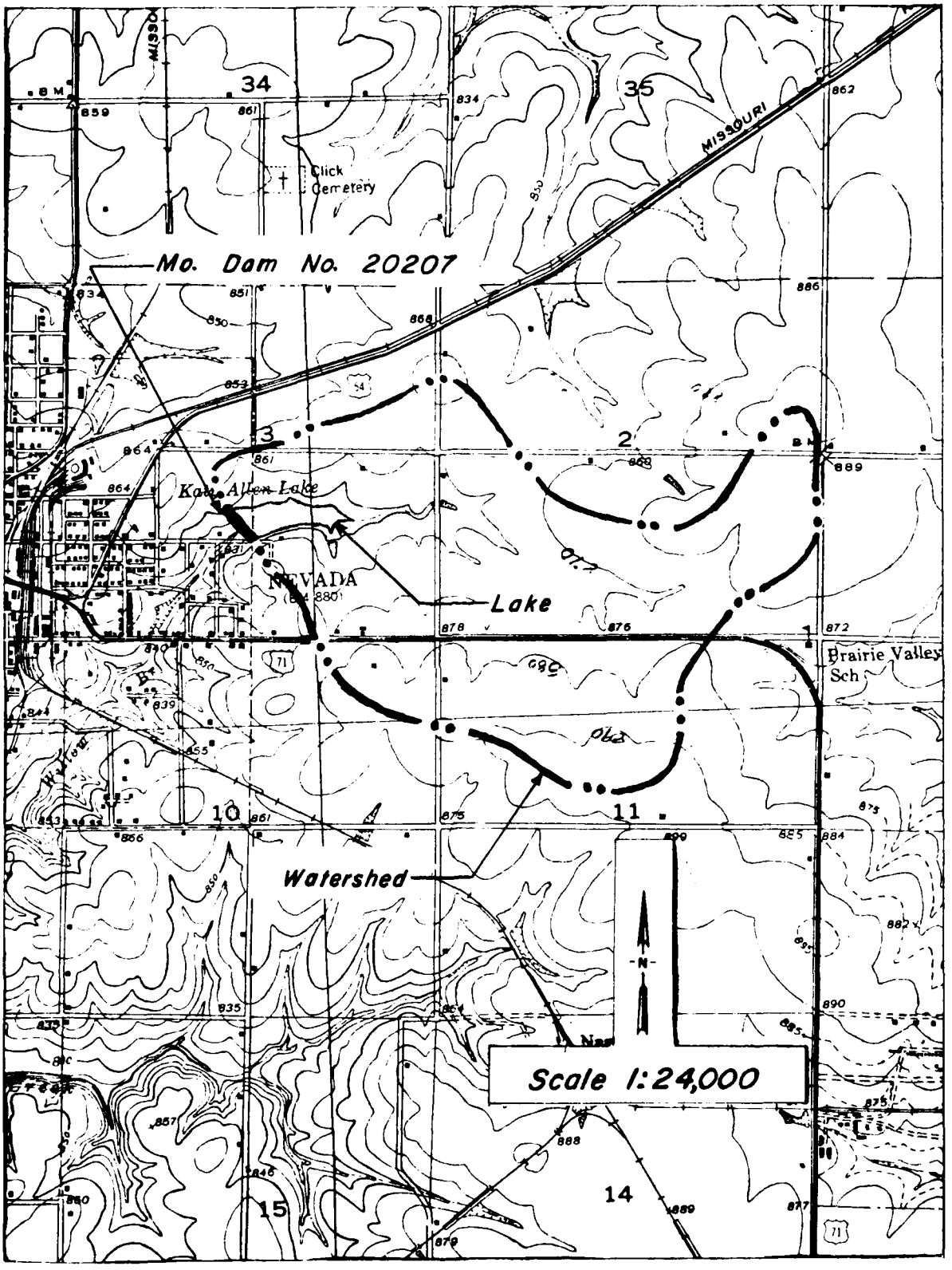
2.5-5

2.5-

THICKNESS OF LOESSIAL DEPOSITS

SHEET 2 OF APPENDIX B

APPENDIX C



LAKE AND WATERSHED MAP

Sheet 1 Appendix C

HYDRAULICS AND HYDROLOGIC DATA

Design Data: From Field Measurements and Computations

Experience Data: No records are available.

Visual Inspection: At the time of inspection, the pool level was approximately 0.17 feet below the crest of the primary spillway.

Overtopping Potential: Flood routings were performed to determine the overtopping potential. The watershed and the reservoir surface areas were obtained by a planimeter-from the U.S.G.S. Nevada, Missouri 7.5 minute quadrangle map. The storage volume was developed from this data. A 5 minute interval unit graph was developed for this watershed, which resulted in a peak inflow of 770 c.f.s. and a time to peak of 35 minutes. Application of the probable maximum precipitation minus losses results in a flood hydrograph peak inflow of 6835 c.f.s. Rainfall distribution for the 24 hour storm was according to EM 1110-2-1411.

Based on our analyses, the combined spillways will pass 41 percent of the Probable Maximum Flood (PMF). The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorologic and hydrologic conditions that are reasonably possible in the region. The recommended guidelines from the Department of the Army, Office of the Chief of Engineers, require that the structure (small size with high downstream hazard potential) pass 50 to 100 percent of the PMF, without overtopping. Considering that the maximum storage capacity is only 113 acre-feet and the height of the dam is about 25 feet, 50 percent of the PMF has been determined to be the appropriate spillway design flood.

The routing of 50 percent of the PMF through the spillway and dam indicates that the dam will be overtopped by 0.30 ft. at elevation 849.0 ft., MSL. The duration of the overtopping will be 0.58 hours, and the maximum outflow will be 3372 c.f.s. The maximum discharge capacity of the combined spillways is 2635 c.f.s. Analysis of the data indicates that the 100-year frequency flood will not overtop the dam.

OVERTOPPING ANALYSIS FOR KATY ALLEN DAM

INPUT PARAMETERS

1. Unit Hydrograph - SCS Dimensionless - Flood Hydrograph Package (HEC-1); Dam Safety Version Was Used.
   Hydraulic Inputs Are as Follows:

   a. Twenty-four Hour Rainfall of 26 Inches for 200 Square Miles - All Season Envelope

   b. Drainage Area = 625 Acres; = 0.98 Square Miles

   c. Travel Time of Runoff 0.95 Hrs.; Lag Time 0.57 Hrs.

   d. Soil Conservation Service Soil Group B

   e. Soil Conservation Service Runoff Curve No. 85 (AMC III)

   f. Proportion of Drainage Basin Impervious 0.04

2. Spillways

   a. Primary Spillway: Concrete weir (concrete wall), Trapezoidol, Broad crested weir, Side slopes 1:6.2 and 1:7.2, Bottom Width 17 ft.; C = 2.7.

   b. Emergency Spillway

      Concrete weir (concrete wall)
      Length 60 ft.; Side Slopes 10:1 & 8:1; C = 2.7

   c. Dam Overflow

      Length 550 ft.; Crest Elev. 848.7 ft. MSL;
      C = 3.0

3. Spillway and Dam Rating:

   Curve Prepared by Hanson Engineers. Data Provided To Computer on Y4 and Y5 Cards.
   Equations used: Spillway $Q = CLH^{1.5}$

Note: Time of Concentration From Equation $Tc = \frac{(11.9\ L^3)^{.385}}{(H)^{.385}}$

California Culvert Practice, California Highways and Public Works, Sept. 1942.

SUMMARY OF DAM SAFETY ANALYSIS

1. Unit Hydrograph

   a. Peak - 770 c.f.s.

   b. Time to Peak 35 Min.

2. Flood Routings Were Computed by the Modified Puls Method

   a. Peak Inflow

      50% PMF 3417 c.f.s.; 100% PMF 6835 c.f.s.

   b. Peak Elevation

      50% PMF 849.0; 100% PMF 849.9 ft. MSL

   c. Portion of PMF That Will Reach Top of Dam

      41%; Top of Dam Elev. 848.7 ft. MSL

3. Computer Input and Output Data are shown on Sheets 5 & 6 of this Appendix.

```
A       OVERTOPPING ANALYSIS FOR KATY ALLEN DAM
A       VERNON CO NEVADA MO. VERNON COUNTY PARK
A       HANSON ENGINEERS INC. DAM DESIGN JOB #79511
B    300       0       5
I      5
J      1       6       1
J1   0.3     0.4     0.5     0.6     0.8     1.0
K      0       1                               3       1
K1       INFLOW HYDROGRAPH COMPUTATION
M      1       2    0.98            0.98       1                       1
P      0      26     102     120     130
T                                                      -1     -85             0.04
W2  0.95    0.57
X      0    -0.1       2
K      1       2                       0       4       1
K1       RESERVOIR ROUTING MODIFIED PULS AT KAY ALLEN LAKE
Y                                      1       1
Y1     1                                               60      -1
Y4 844.6   845.1   846.1   847.1   848.1   848.7   849.1   849.6   850.1
Y5     0      19     317     949    1913    2635    3254    4063    4972
$A     0      12      14      15
$E 829.6   844.6   848.7   850.1
$$ 844.6
$D 848.7     3.0     1.5     550
K     99
```

INPUT DATA

SHEET 5 APPENDIX C

********** ********** ********** ********** **********

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

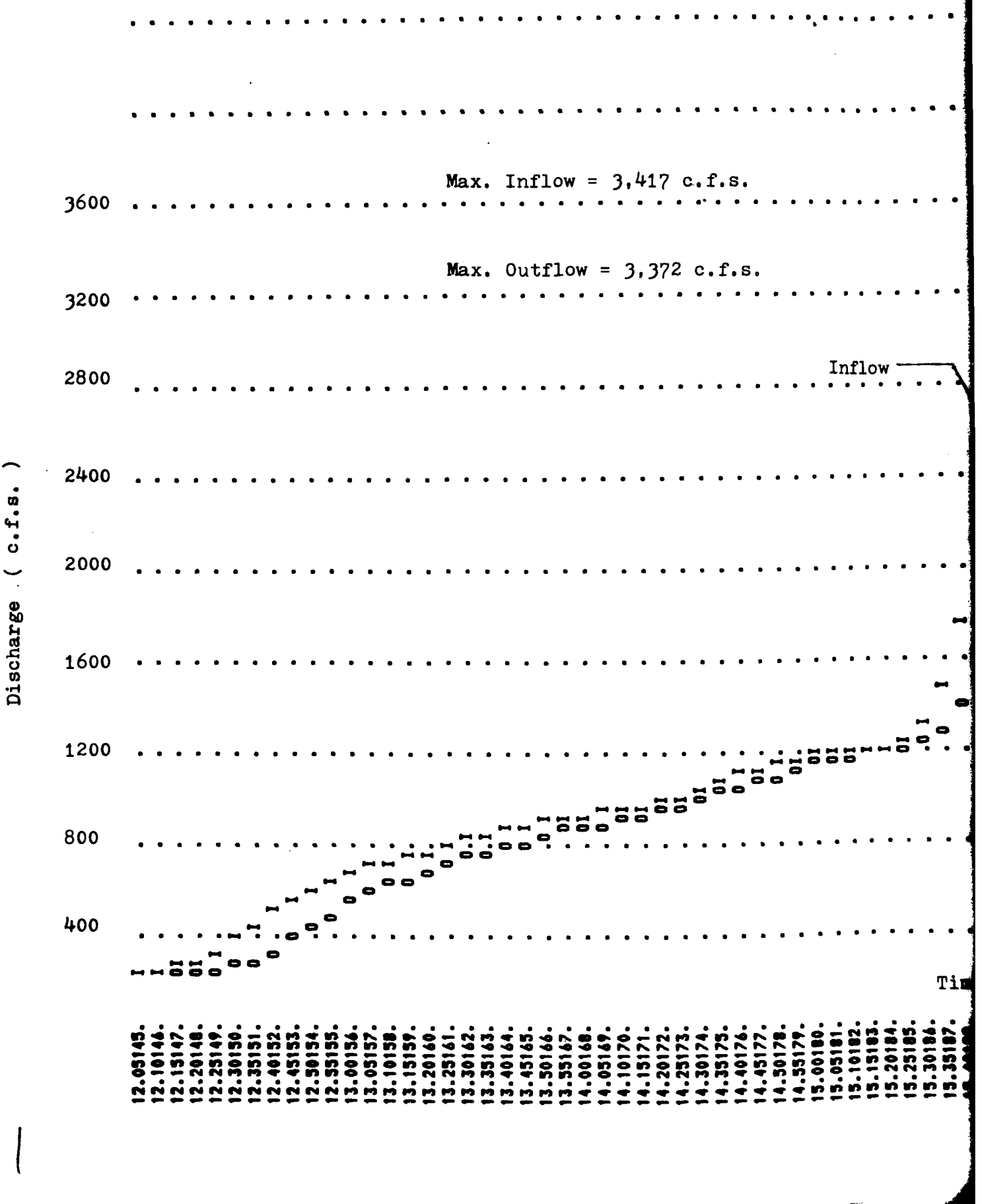
OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
				0.30	0.40	0.50	0.60	0.80	1.00
HYDROGRAPH AT	1	0.98	1	2050.	2734.	3417.	4101.	5468.	6835.
	(	2.54)	(	58.06)(	77.42)(	96.77)(	116.12)(	154.83)(	193.54)(
ROUTED TO	2	0.98	1	1914.	2601.	3372.	4083.	5459.	6832.
	(	2.54)	(	54.19)(	73.65)(	95.49)(	115.61)(	154.58)(	193.45)(

SUMMARY OF DAM SAFETY ANALYSIS

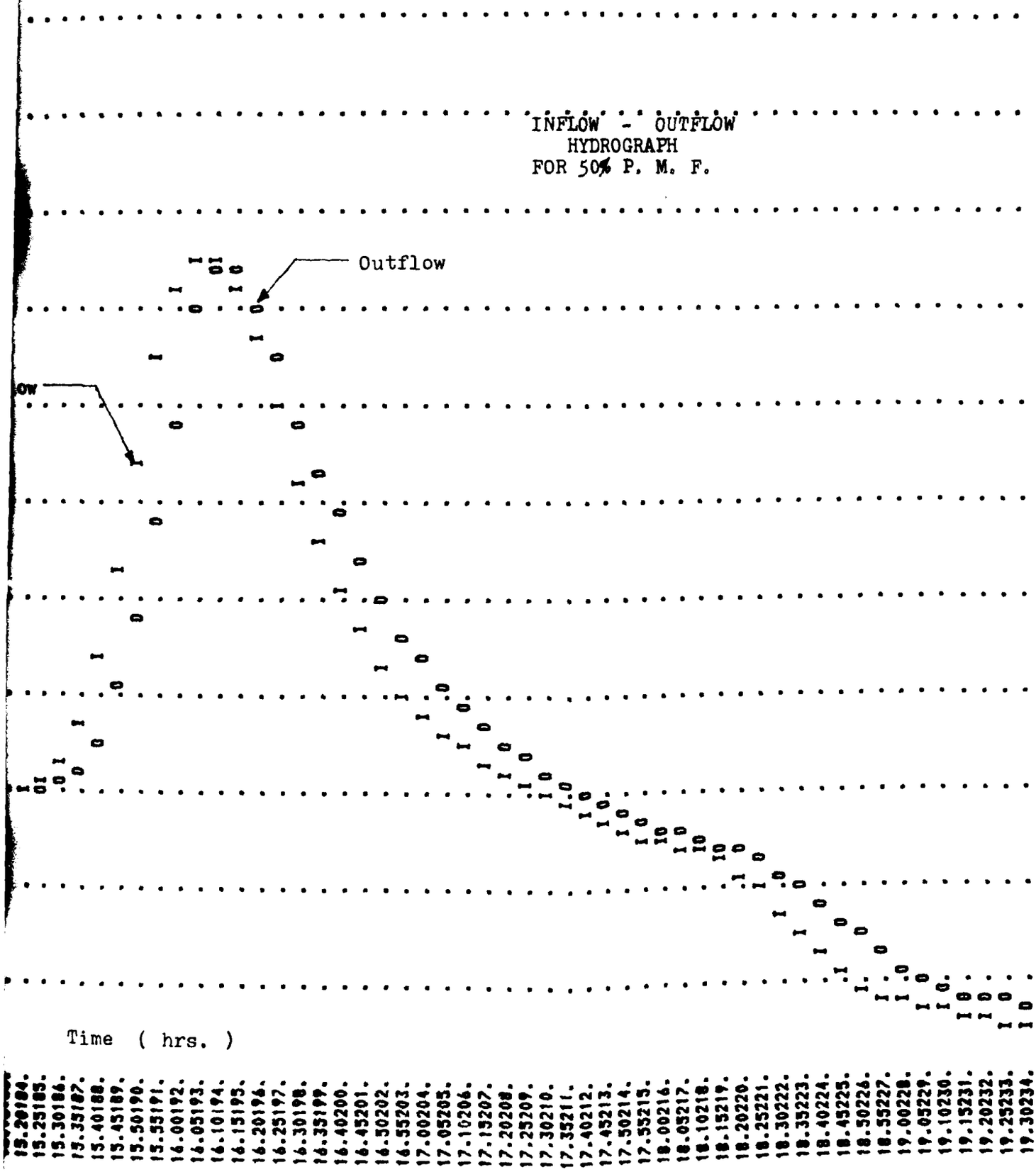
PLAN 1 .....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	844.60	844.60	848.70
STORAGE	60.	60.	113.
OUTFLOW	0.	0.	2635.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
0.30	848.10	0.00	105.	1914.	0.00	16.25	0.00
0.40	848.67	0.00	113.	2601.	0.00	16.25	0.00
0.50	849.00	0.30	117.	3372.	0.58	16.17	0.00
0.60	849.22	0.52	121.	4083.	0.83	16.17	0.00
0.80	849.60	0.90	126.	5459.	1.25	16.17	0.00
1.00	849.91	1.21	131.	6832.	1.75	16.17	0.00


Max. Inflow = 3,417 c.f.s.
Max. Outflow = 3,372 c.f.s.
Inflow
3600
3200
2800
2400
2000
1600
1200
800
400
Discharge (c.f.s.)
Tim
12.05145.
12.10146.
12.15147.
12.20148.
12.25149.
12.30150.
12.35151.
12.40152.
12.45153.
12.50154.
12.55155.
13.00156.
13.05157.
13.10158.
13.15159.
13.20160.
13.25161.
13.30162.
13.35163.
13.40164.
13.45165.
13.50166.
13.55167.
14.00168.
14.05169.
14.10170.
14.15171.
14.20172.
14.25173.
14.30174.
14.35175.
14.40176.
14.45177.
14.50178.
14.55179.
15.00180.
15.05181.
15.10182.
15.15183.
15.20184.
15.25185.
15.30186.
15.35187.

INFLOW - OUTFLOW
HYDROGRAPH
FOR 50% P. M. F.



Time (hrs.)

15.20184.
15.25185.
15.30186.
15.35187.
15.40188.
15.45189.
15.50190.
15.55191.
16.00192.
16.05193.
16.10194.
16.15195.
16.20196.
16.25197.
16.30198.
16.35199.
16.40200.
16.45201.
16.50202.
16.55203.
17.00204.
17.05205.
17.10206.
17.15207.
17.20208.
17.25209.
17.30210.
17.35211.
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APPENDIX D

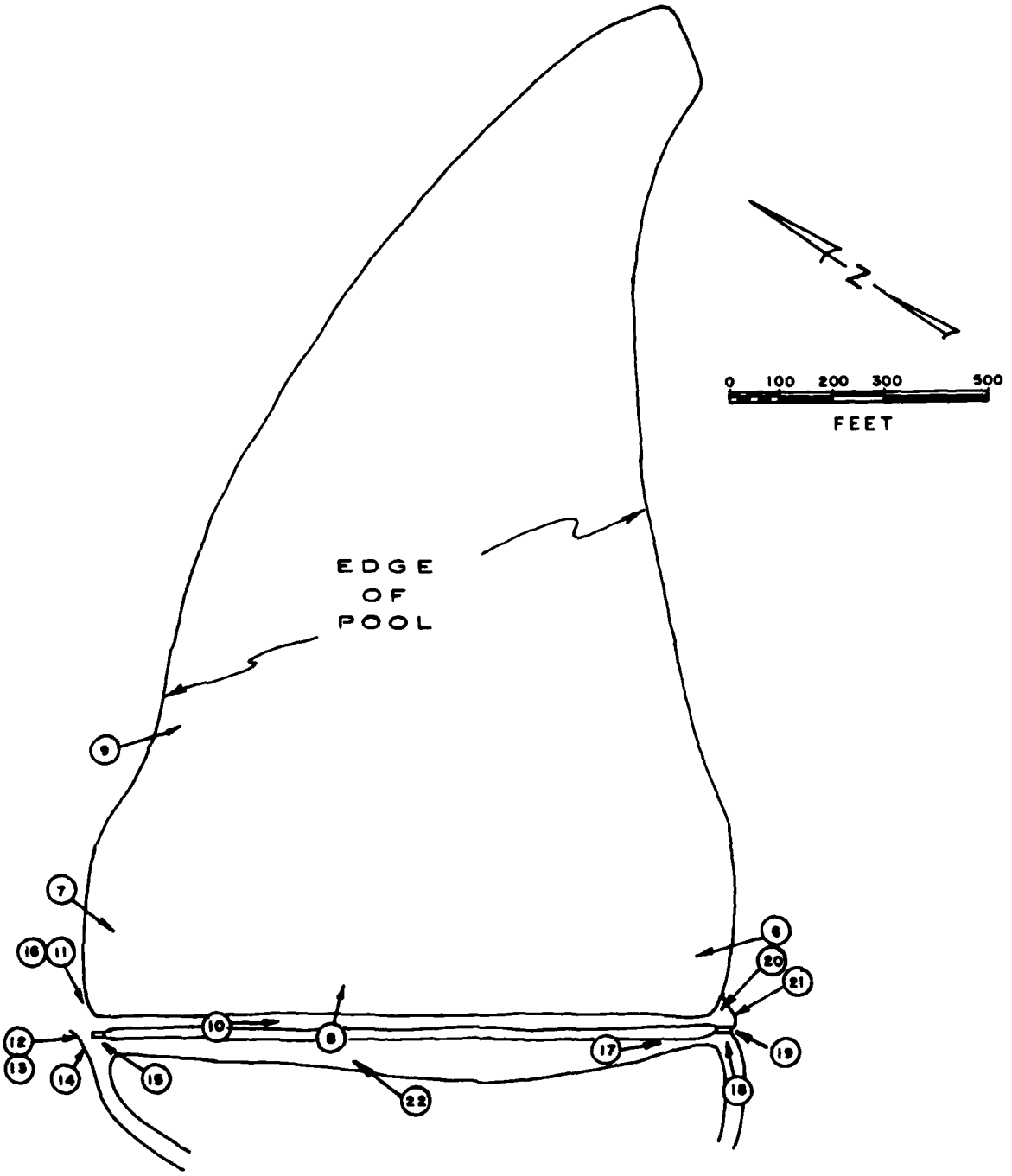


PHOTO INDEX
KATY ALLEN DAM
VERNON COUNTY, MO.

LIST OF PHOTOGRAPHS

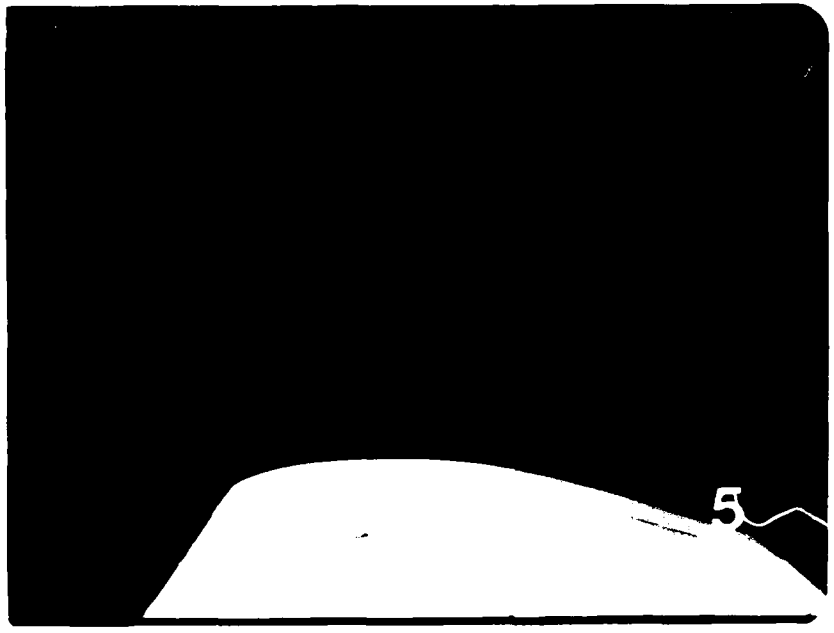
Photo No.	
1.	Aerial Looking Northeast
2.	Aerial Looking Southwest
3.	Aerial Looking East
4.	Aerial of Upstream Face Looking Southwest
5.	Aerial of Embankment Looking Southeast
6.	Upstream Face
7.	Upstream Face
8.	Reservoir Area from Dam
9.	Lake (Note Moss, Algae and Plant Growth)
10.	Crest of Dam Looking South
11.	Approach to Emergency Spillway
12.	Control Section of Emergency Spillway
13.	Emergency Spillway Channel
14.	Control Section of Emergency Spillway
15.	Undermining of Emergency Spillway
16.	Approach to Emergency Spillway
17.	Control Section of Primary Spillway
18.	Outlet Channel of Primary Spillway
19.	Tree in Primary Spillway Approach Channel
20.	Approach to Primary Spillway
21.	Outlet Channel of Primary Spillway
22.	Seepage Area at Downstream Toe


1


2


3


4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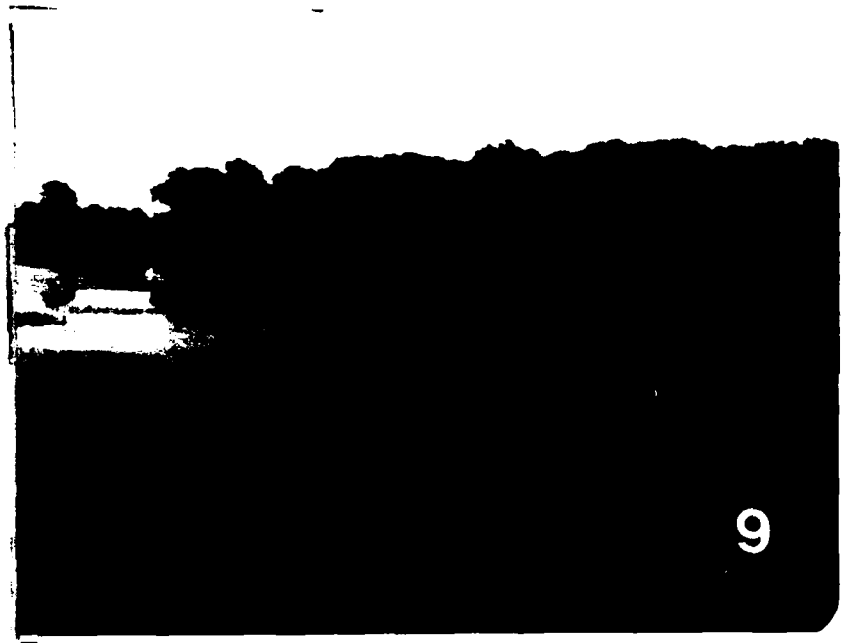
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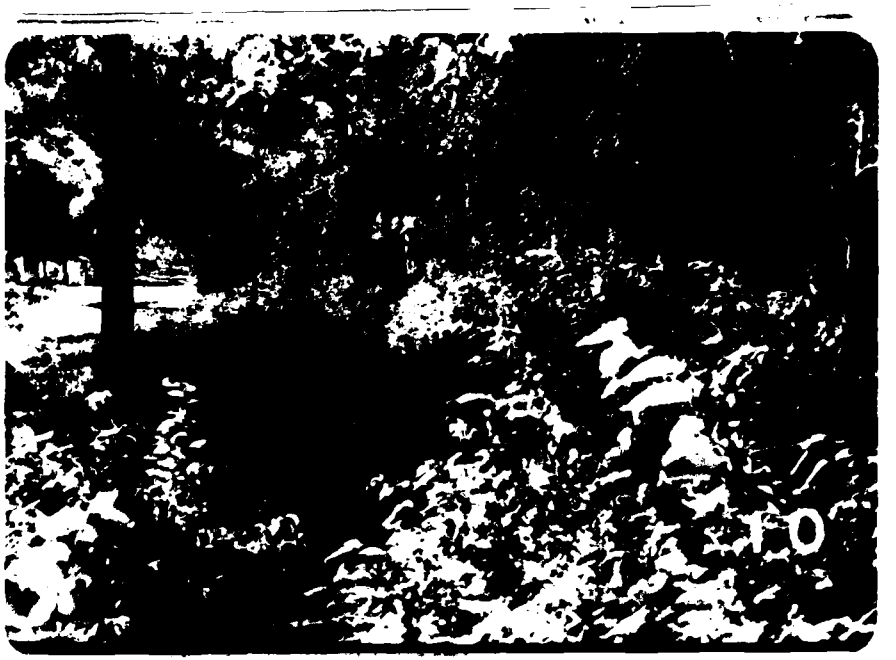
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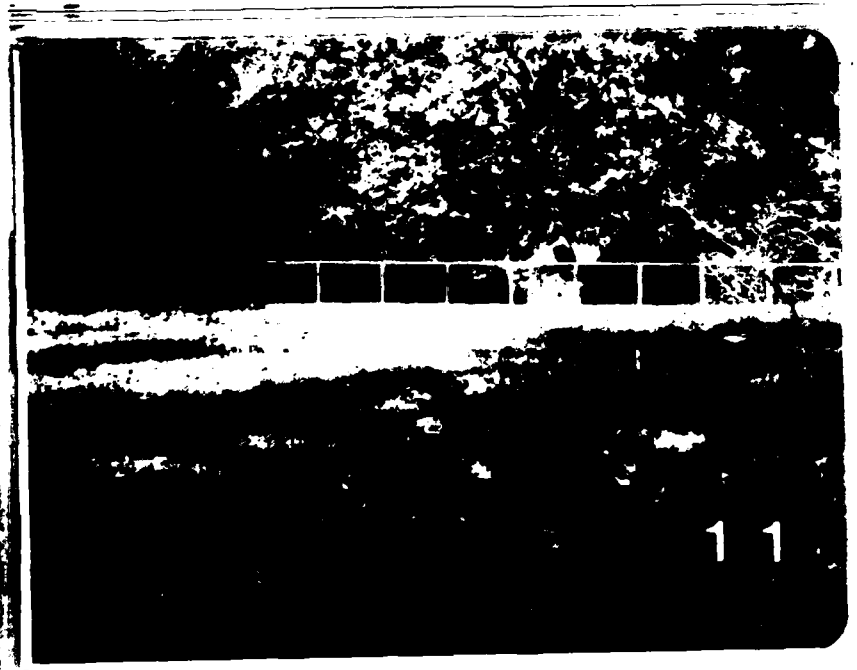
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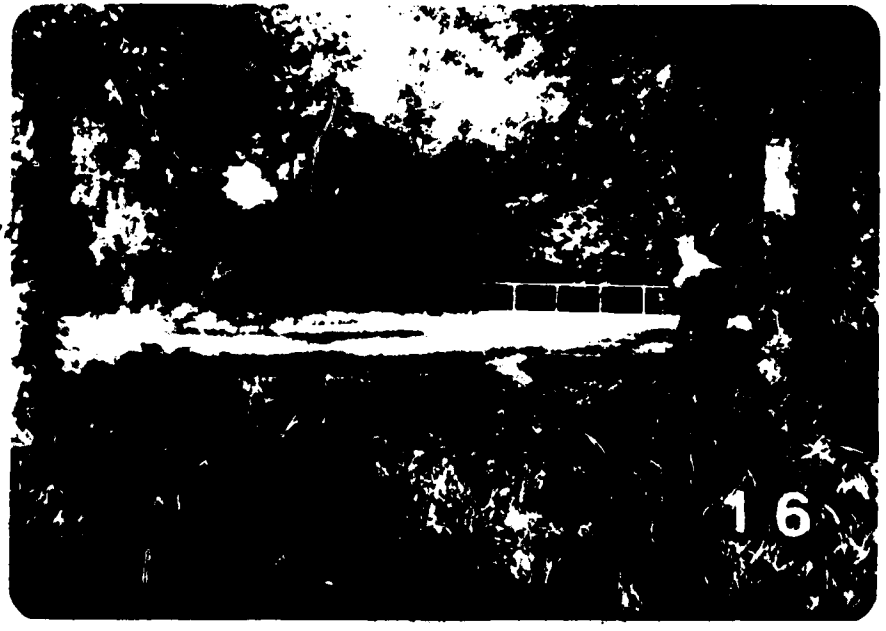
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